

fibres of the spheroids, will produce convex articulations in the lower joints of the prisms. If the generating centres are not equidistant, the forms of the pillars will be irregular, and of different number of angles; and as the compression of the fibres will be greatest on the level of the generating centres, the lower part of the prisms will be most compact.

All the observations hitherto made on the great basaltic masses in nature, seem to confirm this simple theory; and the author bestows some pains in accounting for the appearances which seem at first sight not to agree perfectly with it. Those who shall peruse the paper will, if we are not much mistaken, be particularly gratified with the variety of information they will meet with in this part of the treatise.

Lastly, the author directs his attention to the many instances of other substances, besides basalt, which affect a columnar form, and which afford convincing proofs that their configuration is not confined to either the aqueous or igneous formation. Such are, certain lavas, columns of porphyry found near Dresden, a bed of gypsum at Montmartre, and other masses of various nature. Sandstone, clay, argillaceous iron ore, and many other substances, become prismatic by torrefaction; and prisms of starch formed in drying have often been considered as illustrative of basaltic formation. Some of these are probably to be attributed solely to contraction; and it is shown that they do by no means contribute toward any explanation of the process here in contemplation.

*An Analysis of the magnetical Pyrites; with Remarks on some of the other Sulphurets of Iron. By Charles Hatchett, Esq. F.R.S. Read May 17, 1804. [Phil. Trans. 1804, p. 315.]*

The substance which is the subject of this paper was, till lately, found only in some parts of Norway and Germany; but it now appears, from some specimens in Mr. Greville's collection, that it is likewise to be met with in considerable quantities near the foot of Snowdon in Caernarvonshire. The character by which this kind of sulphuret is chiefly distinguished from the other martial pyrites, is its magnetic property, by which, especially if it have been placed some time between magnetical bars, it will turn a needle completely round, attract and take up abundance of iron filings, and retain this addition to its original power for a considerable length of time.

After an accurate description of the external characters of this ore, Mr. Hatchett enters into a full account of the processes he instituted in order to discover its nature and component parts. In hopes of discovering the cause of the magnetic property which is peculiar to this species, he has entered into an analysis of the other kinds of martial sulphurets, not only natural, but also artificial, and has also paid particular attention to the experiments of others on this subject, particularly those of Mr. Proust, the learned Professor of Chemistry at Madrid, who has taken considerable pains in ascertain-

ing the constituent parts of this ore, both analytically and synthetically. In the progress of this inquiry, a certain analogy soon presented itself, between these compounds of sulphur and iron and those of other inflammable substances, such as carbon and phosphorus, with the same metal, which suggested the idea of some experiments on the subject; from whence various facts were deduced, not only of much curiosity, but also likely to lead to some useful purposes, as will appear hereafter. The principal results of this laborious investigation are,—

1. That the component ingredients of the magnetical pyrites are sulphur, and iron in the metallic state, the former being to the latter in the proportion nearly of 37 to 63.

2. That the chemical and other properties of this substance are very different from those of the common martial pyrites; which, however, are likewise composed of sulphur and iron, but varying in proportion from between 52 to 54 of sulphur, and 48 to 46 of metallic iron. Whence it appears, that the relative proportions in the composition of the magnetical pyrites, and of the mean of the common pyrites, is between 16 and 17.

3. That as the magnetical pyrites agrees in analytical results, as well as in all chemical and other properties, with that sulphuret of iron which hitherto has been only known as an artificial product, there is no doubt that it is identically the same, and that its proportions are probably subjected to a certain law, which, under certain circumstances, may be supposed to act in an almost invariable manner.

4. That in the formation of the common martial pyrites, there is a deviation from this law, and that sulphur becomes a predominant ingredient, variable in quantity, but which, by the present experiments, has not been found to exceed between 54 and 55 per cent.; a proportion, however, which possibly may be surpassed in other pyrites which have not as yet been chemically examined.

5. That iron, when combined naturally or artificially with 36 or 37 per cent. of sulphur, is not only still capable of receiving the magnetic fluid, but it is also rendered capable of retaining it, so as to become in every respect a complete magnet. And the same may in a great measure be inferred respecting iron which has been artificially combined with  $45\frac{1}{2}$  per cent. of sulphur.

6. That beyond this proportion of  $45\frac{1}{2}$  per cent. of sulphur, (at least in the natural common pyrites,) all susceptibility in iron of the magnetic influence appears to be destroyed; and although the precise maximum, which is capable of producing this effect, has not as yet been determined by actual experiment, it is certain that the limits are between 45 and 52; unless some alteration has taken place in the state of the sulphur or iron in the common martial pyrites, different from that which is conceived according to the present state of chemical knowledge.

7. That as carbon, when combined in a certain proportion with iron (forming steel), enables it to become a permanent magnet, and

as a certain proportion of sulphur communicates the same quality to iron, so are the effects of phosphorus found to be ; phosphoret of iron being, in this respect, much the most powerful, at least when considered comparatively with sulphuret of iron.

8 ; and lastly. That as carbon, sulphur, and phosphorus, produce, by their union with iron, many chemical effects, of much similarity, so do each of them, when combined with that metal in certain proportions, not only permit it to receive, but also give it the peculiar power of retaining the magnetical properties ; and thus henceforth, in addition to that carburet of iron called steel, certain sulphurets and phosphurets of iron may be regarded as bodies peculiarly susceptible of strong magnetical impregnation.

Among the observations which are subjoined to this paper, we find some remarks on the vitriolization of pyrites ; from which we collect, that, contrary to the opinion of Mr. Proust, who thought that only those pyrites in which the proportion of sulphur is very small are liable to this change, the vitriolization is not so much owing to the proportion as to the state of the sulphur in the compound ; and that this state is probably the effect of a small portion of oxygen, previously combined with a part or with the general mass of the sulphur at the time of the original formation of the substances ; so that the state of this ingredient is tending to that of oxide.

It is, no doubt, remarkable, that the magnetical properties of the sulphuret of iron, which forms the principal subject of this paper, should never have been adverted to by any of the writers on magnetism. The few who observed it in the natural magnetical pyrites chose to ascribe it to particles of common magnetical iron interspersed in the ore : but from what has been stated, it is evident that this opinion must be relinquished ; since there are certain known proportions of sulphur, as well as of carbon and phosphorus, beyond which the magnetical property will not be obtained, though the proportions beyond this maximum would by no means exclude the interposition of particles of iron. How far the combinations of magnetical sulphurets, carburets, and phosphorets may contribute towards the making artificial loadstones of greater strength than those hitherto known, is a subject recommended to the attention of future observers.

*Remarks on the voluntary Expansion of the Skin of the Neck, in the Cobra de Capello or hooded Snake of the East Indies. By Patrick Russell, M.D. F.R.S. With a Description of the Structure of the Parts which perform that Office. By Everard Home, Esq. F.R.S. Read June 14, 1804. [Phil. Trans. 1804, p. 346.]*

The information we gather from this paper is, that the remarkable expansion of the skin of the neck, which constitutes a principal character in this species, is a voluntary action, distinct from that inflation which all serpents, when irritated, are more or less capable of : that it is owing to a particular set of ribs situated at the neck of the